MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

PEM0026 – TRIGONOMETRY AND GEOMETRY

(Foundation in Engineering)

21 OCTOBER 2019
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **4** pages including the cover page and appendix.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of marks for each question is given.

3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown.

4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

TRIGONOMETRY IDENTITIES

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta=2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B$

$\cos(A\pm B)=\cos A\cos B\mp\sin A\sin B$

$\tan(A\pm B)=\dfrac{\tan A\pm\tan B}{1\mp\tan A\tan B}$

$2\sin A\cos B=\sin(A+B)+\sin(A-B)$

$2\cos A\cos B=\cos(A+B)+\cos(A-B)$

$2\sin A\sin B=\cos(A-B)-\cos(A+B)$

$\sin A+\sin B=2\sin\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\sin A-\sin B=2\cos\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\cos A+\cos B=2\cos\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\cos A-\cos B=-2\sin\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\sin^2\dfrac{A}{2}=\dfrac{1-\cos A}{2}$; $\cos^2\dfrac{A}{2}=\dfrac{1+\cos A}{2}$; $\tan^2\dfrac{A}{2}=\dfrac{1-\cos A}{1+\cos A}$

$\sin\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{2}}$; $\cos\dfrac{A}{2}=\pm\sqrt{\dfrac{1+\cos A}{2}}$; $\tan\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{1+\cos A}}=\dfrac{1-\cos A}{\sin A}=\dfrac{\sin A}{1+\cos A}$

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QUESTION 1 (25 MARKS)

a) Given $\sin\theta < 0$ and $\cos\theta = -\frac{3}{7}$, find the exact values for the remaining trigonometric functions of θ. (5 marks)

b) Simplify the expression:

$$\cos^2(90^\circ - x) + \frac{3\cot(90^\circ - x)}{\cos x \sec^2 x} + \cos(x + 360^\circ)\sin(x - 90^\circ) + \cos(90^\circ + x).$$

(5 marks)

c) Given $y = -3\tan\left(\frac{x}{4}\right)$.

i. State its period and vertical asymptotes. (2 marks)

ii. Sketch the graph and state four points on the graph. (4 marks)

d) Given a triangle with angle $A = 40^\circ$, side $a = 12$ cm and side $b = 15$ cm, find the other dimensions. (9 marks)

QUESTION 2 (25 MARKS)

a) Prove that, $\frac{\cos x + 1}{\cos x - 1} = \frac{1 + \sec x}{1 - \sec x}$. (3 marks)

b) Determine the exact value of $\sin\left[\sin^{-1}\left(\frac{5}{12}\right) + \tan^{-1}\left(-\frac{5}{3}\right)\right]$. (7 marks)

c) Solve the following equations for $0^\circ \le x < 360^\circ$:

i. $\sin 2x = \cos x$ (6 marks)

ii. $\tan 2x + 2\sin x = 0$ (9 marks)

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QUESTION 3 (25 MARKS)

a) Simplify and give your answer in the form of $a+bi$ for

$\frac{2+3i}{1-2i}+2i^9-\frac{3i}{1+2i}+(5-3i)^2$. (6 marks)

b) Convert the equation $x^2-4y=3$ into equation of polar form. (3 marks)

c) Given that $p=3+3i$, $s=1+2i$, and $t=3-2i$. By using De Moivre's Theorem, find $\frac{p^2}{st}$. (9 marks)

d) Given vector $\mathbf{v}=3\mathbf{i}-5\mathbf{j}$ and $\mathbf{w}=-2\mathbf{i}+3\mathbf{j}$, find

i. $\|2\mathbf{v}+\mathbf{w}\|$ (2 marks)

ii. the angle between $\mathbf{v}$ and $\mathbf{w}$. (3 marks)

iii. the value of k so that, the vectors $\mathbf{r}=4\mathbf{i}-k\mathbf{j}$ and $\mathbf{w}$ are orthogonal. (2 marks)

QUESTION 4 (25 MARKS)

a) A circle C_1 passes through the points $(0,1)$, $(1,0)$ and $(3,4)$.

i. Find the equation of C_1. (8 marks)

ii. Determine the center and radius of circle C_1. (4 marks)

iii. If C_2 is the circle $(x+3)^2+(y-4)^2=16$, find the distance between the centers of the two circles. (2 marks)

b) Sketch the graph for parabola $(x+2)^2=-8(y-1)$. Show clearly the vertex, focus and directrix of the curve. (6 marks)

c) Write the equation of a conic section $7x^2-4y^2+28x-8y-32=0$ in standard form. (5 marks)

End of Paper